CLAIMS

What is claimed is:

1. A method for coating a gas turbine component with a thermal barrier coating system by a controlled preoxidation heat treatment, comprising the steps of:

providing a gas turbine component for use at high temperatures;

applying a thin layer of platinum to at least a portion of the component;

forming a single phase platinum aluminide by exposing the thin layer of platinum to a source of aluminum for a preselected time; then,

providing the single phase platinum aluminide with a clean, uniform surface free of oxides, contaminants and local gradients of nickel, aluminum and platinum; then,

preoxidizing the single phase platinum aluminide by heating the component in a preselected partial pressure of oxygen, wherein the preoxidation is accomplished by heating the component to a preselected temperature at a preselected rate so as to form a thin layer of pure alumina over the single phase platinum aluminide; followed by,

applying a ceramic top coat over the thin layer of pure alumina.

2. A method for coating a gas turbine component with a thermal barrier coating system by a controlled preoxidation heat treatment, comprising the steps of:

providing a gas turbine component for use at high temperatures;

applying a thin layer of platinum to at least a portion of the component;

forming a single phase platinum aluminide by exposing the thin layer of platinum to a source of aluminum for a preselected time;

grit blasting the single phase platinum aluminide using a grit of preselected size at a preselected pressure for a time sufficient to achieve a surface finish of between about 32 R_a and 63 R_a; then,

preoxidizing the single phase platinum aluminide by heating the component in a vacuum furnace at a preselected partial pressure of oxygen, wherein the preoxidation is accomplished by heating the component to a preselected temperature at a preselected rate so as to form a thin layer of pure alumina over the single phase platinum aluminide; followed by,

applying a ceramic top coat over the thin layer of pure alumina.

3. The method of claim 2 wherein the step of providing includes providing a gas turbine component comprised of a superalloy material.

4. The method of claim 3 wherein the step of providing includes providing a gas turbine component comprised of a nickel-based superalloy material.

5. The method of claim 2 wherein the step of applying a thin layer of platinum to at least a portion of the substrate includes applying a thin layer of platinum to the substrate by a chemical vapor deposition process.

6. The method of claim 2 wherein the step of applying a thin layer of platinum to at least a portion of the substrate includes applying a thin layer of platinum to the substrate by electrochemical deposition.

7. The method of claim 2 wherein the step of forming a single phase platinum aluminide by exposing the thin layer of platinum to a source of aluminum for a preselected time includes exposing the thin layer of platinum to a source of aluminum for sufficient time and temperature to form a single phase platinum aluminide.

8. The method of claim 2 wherein the step of grit blasting the single phase platinum aluminide using a grit of preselected size at a preselected pressure includes selecting an alumina grit having a size classification from about #60 - #120.

9. The method of claim 8 wherein the step of grit blasting the single phase platinum aluminide using a grit of preselected size at a preselected pressure includes selecting an alumina grit having a size classification of about #80.

10. The method of claim 8 wherein the step of grit blasting the single phase platinum aluminide using a grit of preselected size at a preselected pressure includes selecting a pressure between about 30 psi and about 100 psi.

11. The method of claim 10 wherein the step of grit blasting the single phase platinum aluminide using a grit of preselected size at a preselected pressure further includes selecting a pressure between about 60 psi and about 80 psi.

12. The method of claim 2 wherein the step of preoxidizing the single phase platinum aluminide by heating the component in a vacuum furnace at a preselected partial pressure of oxygen, wherein the preoxidation is accomplished by heating the component to a preselected temperature at a preselected rate so as to form a thin layer of pure alumina includes heating the component in a partial pressure of oxygen between 1000 Mbar and 10^{-5} mbar.

13. The method of claim 12 wherein the step of preoxidizing the single phase platinum aluminide by heating the component in a vacuum furnace at a preselected partial pressure of oxygen, wherein the preoxidation is accomplished by heating the component to a

preselected temperature at a preselected rate so as to form a thin layer of pure alumina further includes heating the component in a partial pressure of oxygen of about 10^{-4} mbar.

14. The method of claim 12 wherein the step of preoxidizing the single phase platinum aluminide by heating the component in a vacuum furnace at a preselected partial pressure of oxygen, wherein the preoxidation is accomplished by heating the component to a preselected temperature at a preselected rate so as to form a thin layer of pure alumina includes heating to a temperature in the range of about 1800° F and 2100° F.

15. The method of claim 14 wherein the step of preoxidizing the single phase platinum aluminide by heating the component in a vacuum furnace at a preselected partial pressure of oxygen, wherein the preoxidation is accomplished by heating the component to a preselected temperature at a preselected rate so as to form a thin layer of pure alumina further includes heating to a temperature of about 2000°F - 2050° F.

16. The method of claim 14 wherein the step of preoxidizing the single phase platinum aluminide by heating the component in a vacuum furnace at a preselected partial pressure of oxygen, wherein the preoxidation is accomplished by heating the component to a preselected temperature at a preselected rate so as to form a thin layer of pure alumina includes heating from near ambient to a temperature in the range of about 2000° F -2100° F in no longer than 45 minutes.

17. The method of claim 16 wherein the step of preoxidizing the single phase platinum aluminide by heating the component in a vacuum furnace at a preselected partial pressure of oxygen, wherein the preoxidation is accomplished by heating the component to a

preselected temperature at a preselected rate so as to form a thin layer of pure alumina further includes heating from near ambient to a temperature in the range of about 2000° F -2100° F in about 11 to 15 minutes.

18. The method of claim 1 wherein the step of applying a ceramic top coat using a PVD technique over the thin layer of pure alumina by applying the ceramic top coat within a preselected temperature range includes applying a yttria-stabilized zirconia using EB-PVD.

19. A gas turbine component having at least a portion of an outer surface coated with a ceramic thermal barrier system that has a single phase platinum aluminide coating with a pure alumina layer formed in accordance with claim 1.